

ANALYZING ARMY RESERVE UNSATISFACTORY PARTICIPANTS
THROUGH LOGISTIC REGRESSION

A thesis presented to the Faculty of the US Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

BRIAN A. DAVIS, MAJOR, USAR
B.S., East Tennessee State University, Johnson City, Tennessee, 1996

Fort Leavenworth, Kansas
2012-01

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 08-06-2012		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From - To) AUG 2011 – JUNE 2012	
4. TITLE AND SUBTITLE Analyzing Army Reserve Unsatisfactory Participants through Logistic Regression				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Brian Davis, Major, USAR				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301				8. PERFORMING ORG REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The United States Army Reserve (USAR) provides forces critical to the success of the Regular Army and to support national military strategy as an operational force. The USAR continues to confront issues associated with a volunteer force serving in a part-time status. For a variety of reasons, some Soldiers are unable to attend regular Battle Assemblies and Annual Training, resulting in being labeled Unsatisfactory Participants. This thesis looks into available individual data through the utilization of logistic regression to see if there are any variables or combinations that help explain a Soldier becoming an Unsatisfactory Participant. It provides an interpretation of the regression results, reports on other statistical measures of prediction, and makes recommendations for future studies.					
15. SUBJECT TERMS Unsatisfactory Participants, Unsatisfactory Participation, Army Reserve, Logistic Regression					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT (U)	18. NUMBER OF PAGES 71	19a. NAME OF RESPONSIBLE PERSON
a. REPORT (U)	b. ABSTRACT (U)	c. THIS PAGE (U)			19b. PHONE NUMBER (include area code)

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Major Brian Davis

Thesis Title: Analyzing Army Reserve Unsatisfactory Participants through Logistic Regression

Approved by:

_____, Thesis Committee Chair
Bill J. McCollum, Ed.D.

_____, Member
David Bitters, Ph.D.

_____, Member
William J. Maxcy, M.A.

Accepted this 8th day of June 2012 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the US Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

ANALYZING ARMY RESERVE UNSATISFACTORY PARTICIPANTS THROUGH LOGISTIC REGRESSION, by Major Brian A. Davis, 71 pages.

The United States Army Reserve (USAR) provides forces critical to the success of the Regular Army and to support national military strategy as an operational force.

The USAR continues to confront issues associated with a volunteer force serving in a part-time status. For a variety of reasons, some Soldiers are unable to attend regular Battle Assemblies and Annual Training, resulting in being labeled Unsatisfactory Participants.

This thesis looks into available individual data through the utilization of logistic regression to see if there are any variables or combinations that help explain a Soldier becoming an Unsatisfactory Participant. It provides an interpretation of the regression results, reports on other statistical measures of prediction, and makes recommendations for future studies.

ACKNOWLEDGMENTS

First, I must thank my wife, Tamatha, for her love, support, and patience.

Tamatha, I truly am blessed to have you by my side and look forward to many decades together.

My daughters, Elizabeth, Emileigh, and Erika, are beautiful, strong-minded, resilient ladies and I am proud of you and thankful that you embrace the “Army Life.”

I am in awe of the professionalism and dedication to student success provided by my thesis committee. Dr. McCollum, Dr. David Bitters and Mr. William Maxcy provided continuous support, recommendations and motivation transforming a hodgepodge of thoughts into this thesis. Mr. Mark Williams, Staff Group Advisor, not only acted as a mentor, but continually volunteered his time to ensure all his students succeeded.

In fifteen plus years in the Army, there have been numerous Civilians and Soldiers, who have enhanced my career, and thus contributed directly and indirectly to the completion of this thesis for whom I will always be indebted.

TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE	iii
ABSTRACT	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS	vi
ACRONYMS	viii
ILLUSTRATIONS	ix
TABLES	x
CHAPTER 1 INTRODUCTION	1
Problem Statement	2
Army Reserve Structure	2
USAR Composition	4
USAR Forces	4
Unsatisfactory Participation	6
Research Questions	8
Limitations and Data Sources	9
Thesis Scope	9
Thesis Outline	9
CHAPTER 2 LITERATURE REVIEW	11
Demographics	11
Socialization	14
Regression	17
CHAPTER 3 RESEARCH METHODOLOGY	22
Data Inputs and Software	22
Regression Analysis	24
Data Transformation/Selection	27
Model and Variable Inclusion/Exclusion	29
Purpose/Output	29
Further Review	31

CHAPTER 4 FINDINGS.....	34
Model Selection	35
Understanding Coefficients	38
Model Power.....	40
Empirical Data Review	41
Contingency Tables	46
Summary	48
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS	49
Conclusions.....	49
Recommendations.....	51
APPENDIX A Excerpt from DA Form 3540	54
APPENDIX B Termination of Incentive Payments.....	55
APPENDIX C Demographic Codes	57
BIBLIOGRAPHY	59
INITIAL DISTRIBUTION LIST	61

ACRONYMS

BA	Battle Assembly
MSC	Major Support Command
RA	Regular Army
RSC	Regional Support Command
UIC	Unit Identification Code
USAR	United States Army Reserve

ILLUSTRATIONS

	Page
Figure 1. USAR Unit Types	3
Figure 2. RSCs/MSCs	23
Figure 3. Logistic Regression Model–(Natural Log of Odds Ratio).....	26
Figure 4. Logistic Regression Model–Probability (antilog of odds ratio)	27
Figure 5. Akaike Information Criteria (AIC)	31
Figure 6. Chi–Square Statistic Calculations	32
Figure 7. Model Comparisons with Interaction.....	37
Figure 8. Best Model in Coefficient Format	38
Figure 9. Standardized Coefficients	39
Figure 10. Percent of Unsatisfactory Participants by Grade	42
Figure 11. Percent of Unsatisfactory Participants by Age	43
Figure 12. Percent of Unsatisfactory Participants by RSC	45
Figure 13. Percent of Unsatisfactory Participants by State/Territory	45
Figure 14. Observed vs. Expected Unsatisfactory Participants by Grade.....	47
Figure 15. Observed vs. Expected Unsatisfactory Participants by Age	47

TABLES

	Page
Table 1. Selected Reserves Composition.....	5
Table 2. Breakdown of Assigned Selected Reservists	6
Table 3. Output of Logistic Regression without Interaction.....	36
Table 4. Model Accuracy.....	41
Table 5. Breakdown of Unsatisfactory Participants.....	50

CHAPTER 1

INTRODUCTION

Behind the regular army must always stand the great reserve army consisting of able-bodied men of the nation, so trained as to be promptly available for military service if needed, but following their normal occupations in time of peace.

— Major General Leonard Wood, 1916

Since the first 160 surgeons were recommended for appointment into the Medical Reserve Corps in 1908, the Soldiers of United States Army Reserve (USAR) have defended the United States at home and in foreign lands alongside their active duty counterparts. These “Citizen Soldiers,” a title bestowed upon reservists during the Revolutionary War, augment the Regular or Standing Army.¹ Since these modest beginnings, the USAR has grown to fiscal year 2011 authorized end strength of 205,000. Over half of the Reservists serve in a variety of Combat Service Support (CSS) roles, to include the only Army organization with Military Occupation Skills (MOS) in railway operations and over 90 percent of the Army’s Civil Affairs organizations. The skills possessed by USAR Soldiers make the Army Reserve critical in supporting the Regular Army (RA), ultimately contributing to the success of long-term military operations as expressed in the USAR mission statement:

The Army Reserve's mission, under Title 10 of the US Code, is to provide trained, equipped, and ready Soldiers and cohesive units to meet the global requirements across the full spectrum of operations. The Army Reserve is a key element in The Army multi-component unit force, training with Active and National Guard units to ensure all three components work as a fully integrated team.²

The USAR owes its creation to the need for a strategic reserve available during times of national emergency, but since the Gulf War in 1990 the focus and utilization of

reserves is as an operational force. Lieutenant General Jack C. Stultz, Commanding General, United States Army Reserve Command (USARC) stated on 22 April 2011:

For more than 100 years, the United States Army Reserve has served as the nation's federal strategic force in reserve, supporting the war and peacetime needs of the Regular Army....The steady, consistent, and recurring demand for Army Reserve capabilities during this decade has posed significant challenges for a force organized and resourced as a strategic reserve. In response, the Army Reserve recast itself from the part-time strategic reserve role to a fully integrated and critical part of an operational, expeditionary Army that supports the nation's evolving and challenging wartime requirements.³

Major General Wood recognized in 1916 that the military readiness of these reserve units must be equal to that of the RA units. But that was nearly 100 years ago; accomplishing today's Reserve mission requirements is more complicated due to the duality of the Reservist.

Problem Statement

The Army Reserve requires commitment and participation from the members of its force to accomplish its mission. Approximately 90 percent of the Selected Reservists are Troop Program Unit (TPU) Soldiers with requirements to participate in drill weekends and Annual Training. Unfortunately, today over six percent of these TPU Soldiers are labeled Unsatisfactory Participants for their failure to attend mandatory formations. The holes in formations created by absent Soldiers affect unit readiness and ultimately force commanders to cross-level Soldiers to meet mission requirements.

Army Reserve Structure

The USAR command structure consists of various units classified into three command types: Operational and Functional (O&F) Commands, Training Commands, and Support Commands. There are sixteen O&F Commands that are deployable as

headquarters or as commanding units regardless of geographic location.⁴ Six Training Commands provide training for Army National Guard (ARNG), RA and USAR Soldiers, to include the 166th Aviation Brigade, which has the responsibility for all reserve aviation mobilizations.⁵ The Support Commands are distributed geographically throughout the US in seven commands that provide base operation and administrative support, as well as an eighth unit that is the Army Reserve Careers Division.⁶ The majority of USAR units are responsible for combat service support; only one percent of the manning is in combat arms (figure 1).

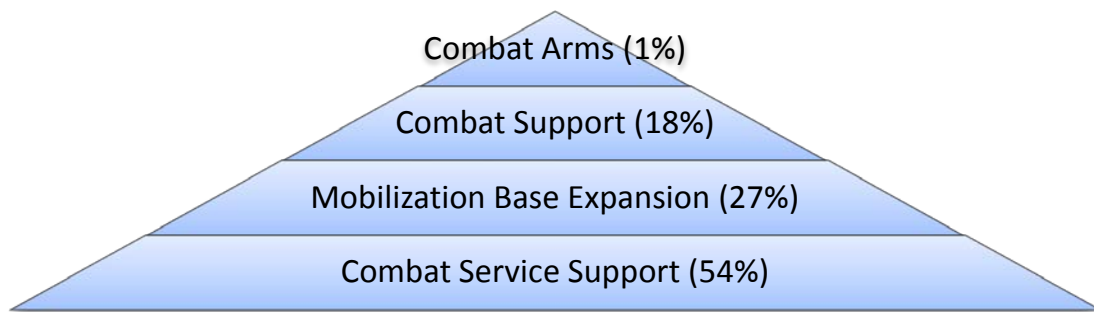


Figure 1. USAR Unit Types

Source: Created by author, data from Army Reserves Website, “Every Soldier has a role. Every role has a purpose,” www.armyreserve.com (accessed October 14, 2011).

Every military organization has a six alpha-numeric character Unit Identification Code (UIC) that provides the basic building block for accountability, responsibility, and command structure of all reserve units. The first four digits of the UIC provide the detailed information necessary to identify the unit at the battalion level and provide the lowest command data used for determining the frequency of Unsatisfactory Participants for this thesis.

USAR Composition

Over half of the assigned USAR strength consists of junior enlisted Soldiers in the ranks of Private through Specialist or Skill Level One (SL1) according to data from Army Reserve G1 Manning Division (September 2011). Non-Commissioned Officers account for a third of the force and the rest are Officers and Warrant Officers. Despite being a combat multiplier and not combat arms heavy, the reserves are primarily male: nearly 77 percent. Caucasians are the dominant ethnicity in reserve formations at over 50 percent of the strength, while Caucasians, Blacks and Hispanics account for all but 6.7 percent of the total ethnic makeup. The ethnic composition of the Reserves is slightly more diverse than in 2001 as Caucasians, Blacks, and Hispanics made up 94.2 percent of the force. Over the past decade the force has become slightly “younger” with SL1’s accounting for just over 47 percent as of September, 2001, while in 2011 accounting for over 50 percent. There currently are two percent more males now than in 2001. The demographic makeup of the Reserves has remained nearly unchanged since 2001 despite being engaged in combat operations nearly as long.

USAR Forces

All members of the Army Reserve, to include those on the retired rolls, are part of the Total US Army Reserve, while the Selected Reserves are those serving either as Troop Program Unit (TPU), as Active Guard Reserve (AGR), or as Individual Mobilization Augmentee (IMA) Soldiers as seen in table 1. The Ready Reserve is composed of TPU, AGR, and IMA Soldiers along with those in the Individual Ready Reserve (IRR).

Table 1. Selected Reserves Composition							
Composition		Gender		Race/Ethnicity			
Source	Selected Reserves	Male	Female	Hispanic	Caucasian	Black	Other
Enlisted	82.7%	63.8%	18.9%	12.1%	46.4%	18.9%	5.3%
Officer	15.8%	11.8%	4.0%	1.1%	10.7%	2.7%	1.2%
WO	1.6%	1.3%	0.2%	0.1%	1.1%	0.3%	0.1%

Source: Created by author. Table data from the Army Reserve, G-1, Manning Division, Fort Belvoir, Virginia, current as of September 2011.

Troop Program Unit Soldiers are the ones normally associated with the word “Reservist,” as they are required by regulation to attend all Battle Assemblies (BAs) and Annual Training (AT). Battle Assemblies are four-hour blocks of time with a Soldier acquiring four BAs over a typical training weekend (multiple Battle Assemblies or (MBAs)) for a total of 48 BAs annually. AGR Soldiers serve in full-time support roles either in reserve units or alongside RA Soldiers in multi-component commands.

Individual Mobilization Augmentees, the smallest group in the Selected Reserve, are Soldiers called to serve in the temporary mobilization actions. According to Army Regulation (AR) 140-145 paragraph 1.6a, “The projected military manpower requirements needed to respond to future contingency operations and/or actual mobilization far exceed the Army’s normal peacetime staffing levels.”⁷ Soldiers in IMA status must also be prepared to be called to active duty in a time of war.

All Soldiers are required to serve a minimum of eight years, but not all Soldiers sign up to serve on active duty or in a reserve unit for this required time. Those Soldiers who have served less than eight years are automatically placed in the IRR. Soldiers in the

IRR are subject to recall to active or reserve duty depending on the needs of the Army. The approximate count of these Soldiers in the Selected Reserves is found in table 2.

Table 2. Breakdown of Assigned Selected Reservists		
Category	Count	Percent
TPU	185995	90.80%
AGR	15950	7.80%
IMA	2858	1.40%
Selected Reservists	204803	100.00%

Source: Created by author. Table data from the Army Reserve, G-1, Manning Division, Fort Belvoir, Virginia, current as of September 2011.

Unsatisfactory Participation

There are multiple reasons why TPU Soldiers become Unsatisfactory Participants, varying from lack of integration in the unit to civilian job requirements. These multiple reasons create the difficulties that commanders have to address when categorizing a missed drill or missed Annual Training as unexcused. If Soldiers miss nine BAs without being excused by the Commander, or fail to attend all of the Annual Training events in a rolling annual period, they are labeled Unsatisfactory Participants. The IMA and IRR Soldiers who are called back to reserve duty are subject to the same accountability rules as TPUs, but their frequency of missed attendance is outside the scope of this study. Soldiers may receive no more than four unexcused absences during a training weekend (four four-hour periods). For every unexcused absence, the commander sends a letter (Army Regulation (AR) 135-91, 1-20) to the Soldier listing the total number of unexcused absences and providing a warning about becoming an Unsatisfactory

Participant. The commander has the ultimate decision authority about how to characterize absences.

The commander may label an absence as excused depending on the circumstances and whether the Soldier provides justification for missing the training. AR 135-91 provides guidance on how to handle reasons for missing drill; in particular, section II, paragraph 4-8 states “Absences may be excused when sickness, injury, or some other circumstance beyond the Soldier’s control caused the absence.”⁸ Thus, a commander has the ability to decide how to characterize missed training, either increasing or decreasing the number of Unsatisfactory Participants, because of interpretation of the regulation.

Becoming an Unsatisfactory Participant is a violation of the Uniform Code of Military Justice (UCMJ), causing the Soldier potentially to be removed from military service. Upon entrance into the Army Reserves, the Soldier must sign a contract which states the length of service, MOS, etc. Included in the documentation that each enlisted member must sign is Department of the Army Form 3540 (DA 3540) “Certificate and Acknowledgment United States Army Reserve Service Requirements and Methods of Fulfillment,” which includes a discussion of required attendance. Section VII of DA 3540, unsatisfactory participation, spells out the requirements for attendance and the consequences of failing to meet requirements; it can be reviewed at the army publication website. An excerpt is at Appendix A.

A Soldier who becomes an Unsatisfactory Participant may be reduced in rank (if enlisted), reassigned, or placed in the IRR depending on commander’s discretion. A Soldier considered by the commander as unsuitable for service is discharged from the Reserves.⁹ The service of a discharged Service Member may be characterized as Other

Than Honorable, resulting in annulment of education incentives and cancellation of any unpaid bonuses which are part of the Selected Reserve Incentive Program (SRIP). Most recently a memorandum, “Termination and Recoupment of Incentives for Unsatisfactory Participants,” dated October 31, 2011 was sent out to all Reservists (Appendix B). This memorandum states “Effective 1 Nov 11, Soldiers with an unexcused absence from Battle Assembly (BA) that remains unexcused for more than 90 days will have their SRIP incentives terminated.”

The ambiguity within the regulation for the determination of unexcused or excused absences forces the question of whether variation in the number of Unsatisfactory Participants is solely commander-based or whether there are other factors that lead to a Soldier becoming an Unsatisfactory Participant.

Research Questions

What demographic data best explain a Reservist’s becoming an Unsatisfactory Participant from missing scheduled drills and Annual Training?

The secondary research questions are:

1. What personal situations to include age, marital status, and rank best explain absenteeism?
2. What environmental conditions such as geographic region best explain absenteeism?
3. What is the best model, given available data, to explain the observed levels of unsatisfactory participation?

Limitations and Data Sources

This thesis uses only unclassified data and sources. The current count used for Unsatisfactory Participants is as of September 2011. This thesis will review previous studies to determine potential for forecasting Unsatisfactory Participants. It will limit the discussion just to those Soldiers in TPUs and based on the outcome of the study will make recommendations for future work. All quantifiable data, unless otherwise noted, are provided by Army Reserve, G-1, Manning Division, as the proponent for personnel data for the Reserves.

Thesis Scope

Despite the Army Reserve's division into distinct separate but supporting groups ranging from the IRR to AGR, this thesis focuses only on the accountability of TPU Soldiers. It reviews the combination of characteristics of those Soldiers who routinely are at training and those prone to fall into the category of Unsatisfactory Participant to identify any explanatory variables or combinations thereof. The purpose is to determine if there are factors that explain which Soldiers are most apt to become Unsatisfactory Participants and to create a model capable of identifying those Soldiers.

Thesis Outline

Chapter 2 consists of a literature review of previous work and findings related to the topic of unsatisfactory performance. Chapter 3 explains the methodology used in contrasting the characteristics of the Soldiers deemed Unsatisfactory Participants with those of the Soldiers who routinely appear for required formations. Chapter 4 develops a regression model commanders can use to assess the likelihood of Soldiers being absent

from BAs and Annual Training. Chapter 5 provides findings and recommendations for future studies.

¹Morris Janowitz, "The Citizen Soldier and National Service," *Airpower Journal* (November-December 1979), <http://www.airpower.maxwell.af.mil> (accessed September 9, 2011).

²United States Army Reserve, "The Mission of the Army Reserve," <http://www.usar.army.mil/> (accessed October 14, 2011).

³My Army Reserve, "Army Reserve- celebrating 103 Years with Soldiers and Families," <http://myarmyreserve.dodlive.mil/> (accessed October 14, 2011).

⁴United States Army Reserve, "U.S. Army Reserve Command," <http://www.usar.army.mil/> (accessed October 14, 2011).

⁵United States Army Reserve, "Operational and Functional Commands," <http://www.usar.army.mil/> (accessed October 14, 2011).

⁶United States Army Reserve, "Training Commands," <http://www.usar.army.mil/> (accessed October 14, 2011).

⁷Department of the Army, Army Regulation (AR) 140-45, *Individual Mobilization Augmentee (IMA) Program* (Washington, DC: Government Printing Office, 2007), 3.

⁸Department of the Army, Army Regulation 135-91, *Service Obligations, Methods of Fulfillment, Participation Requirements, and Enforcement Procedures* (Washington, DC: Government Printing Office, 2005), 12.

⁹*Ibid.*, 32.

CHAPTER 2

LITERATURE REVIEW

With unsatisfactory participation averaging 4.8 percent from April 2006 to September 2011, the problem has habitually caught the eyes of commanders, and has served as the basis for multiple studies on this topic. This thesis will review previous research, as well as journal articles that have used various methods of researching the ongoing issue of voided spaces within the USAR ranks resulting from Unsatisfactory Participants. This chapter begins with a review of a demographic study followed by a review of the socialization process that includes demographics and survey data. The final review is of a study similar to this thesis that is quantitative in nature and looks at descriptive factors of the Soldiers to gain insight into Unsatisfactory Participants.

Demographics

In 1999, Kathryn M. Kocher and George W. Thomas conducted a study entitled “Profile of Unsatisfactory Participant Losses from the USAR” on similarities between not only Unsatisfactory Participants, but all Soldiers leaving the USAR. This looked at common characteristics of those leaving the Reserves because of chapter action as Unsatisfactory Participants, Voluntary Leavers (those that separate from the service), No Shows (those that never show to their units), transfers to RA, and those that fulfilled their service obligation, using data from 1994 to 1996.¹ The study focused only on enlisted prior service and non-prior service Soldiers and chose not to consider Officers, or Warrant Officers. The commonalities of the TPUs gleaned from the study do not appear

different from today, yet the count of Unsatisfactory Participants has declined dramatically from over 23,000 to an approximate 12,000 in September 2011.

Regardless of time or mission the USAR has had the same issues and concerns over unsatisfactory participation: understanding factors common to those who fail to attend mandatory formations.

Service in a USAR Troop Program Unit requires a substantial commitment of time and energy and often competes with family and civilian job responsibilities. Some reservists never appear at their assigned TPUs (no shows) while others participate initially but eventually fail to attend required drills and are dropped from the organization (Unsatisfactory Participants).²

The study aimed to identify significant characteristics of an Unsatisfactory Participant: from basic characteristics of ethnicity, sex, age, and mental proficiency on required Army entry tests to those characteristics associated with the Army: MOS, rank, and previous military experience. “A typical 1995-96 USAR Unsatisfactory Participant was a white, unmarried male whose highest level of education was a high school diploma.”³ Once a Soldier had served on active duty or had prior Reserve service, he was considered prior service, but regardless of previous experience or not the most likely rank for an Unsatisfactory Participant was E4. But it also should be noted that the rank with the most Soldiers is E4; currently, 31.4 percent of the Soldiers in TPUs are E4s.

The Kocher and Thomas thesis used data provided by the Standard Installation and Division Personnel Reporting System (SIDPERS), the Army’s personnel system, which provides a wealth of personal data on each Soldier. One category located on each enlisted member’s personnel file is the Soldier’s Armed Services Vocational Aptitude Battery (ASVAB) scores. Soldiers joining the Army as Officers are not required to participate in the same testing. In times of greater demand for recruits, entrance exam

standards may be lowered; in 2011, the Army had some of the most rigid requirements in its history for entrance into the service. However, in 1996 there were more categories of acceptable scoring criteria, but even so those entering the Army in the grade of E4 were to be “considered high quality” based upon the outcome of entrance exam testing.⁴ As in most other professions there are some positions that are more critical than others, and the Army’s MOSs are no different. The Unsatisfactory Participant as an E4 typically did not have a priority MOS, but was receiving a bonus despite being at the same pay grade for nearly two years.⁵ It appears that those Soldiers who became Unsatisfactory Participants had been integrated into a unit, were not straight out of high school, and had competent skills. However, the study profoundly concludes that Unsatisfactory Participants “joined the Reserves at an earlier age than did USAR members or other loss groups. They are younger, lower ranking, have spent less time-in-grade, and have received fewer incentive benefits than other types of losses.”⁶

Unsatisfactory Participants are not the only way a TPU, as well as the entire USAR, loses trained Soldiers from their formations. There are Soldiers who go through Basic Training and Advanced Individual Training, but never report to their units (No Shows) for a variety of reasons from lack of transportation to job conflicts. Thus, another category is Voluntary Leavers who request a release from their obligation for very similar reasons as No Shows. The findings of the study show that the category of Voluntary Leavers is the highest loss category for prior service Soldiers, while Unsatisfactory Participants is the number one loss category for non-prior service.⁷ The conclusion of this study is that Soldiers who are likely to become Unsatisfactory Participants display many personal and military background issues indicating that they face particular challenges

when adjusting to the TPU environment and that they may be seriously "at risk" of dropping-out.⁸

The Kocher and Thomas study falls short of pinpointing why a Soldier becomes an Unsatisfactory Participant, and settles for drawing a picture of a Soldier who stops showing up for drill. It states that there are challenges for these Soldiers that are red flags, but for the most part these challenges are the same as for other Reservists—civilian career conflicts, distance from the TPU and personal conflicts. However, there does appear to be a difference in commitment between prior service and non-prior service Soldiers; non-prior service are more inclined to have a pattern of missed BAs. While this study is over a decade old, it still describes of a force looking to fill its ranks more completely and it improves understanding of why some fail to fulfill their duties.

Socialization

Whereas the Kocher and Thomas thesis draws the line at quantifiable data, Bob Barrios-Choplin, Aimee Kominiak, and George Thomas collected survey data in 1999 in their study entitled “Reasons for Unsatisfactory Participation in the Army Reserve: A Socialization Perspective.”⁹ The study was conducted through surveys to 100 junior enlisted Soldiers who became Unsatisfactory Participants within their first year in a unit in an effort to determine factors that led to the Soldiers’ decisions to stop participating in BAs. The article provides linkages among recruiting, expectations, job satisfaction, and other factors and their impacts on the Soldier’s decision to exceed the Army’s allowed standards for missed training. Through these surveys the authors were able to gain insight into subjective reasons for no longer attending drills and to provide potential recommendations for reducing the occurrences of unsatisfactory participation.

Choplin and his team looked at the various ways a civilian receives information about beginning the transformation into becoming a Soldier. The first step the civilian makes is as an applicant entering a recruiting station where he or she is introduced to the vast opportunities of Army service. The recruiter has the opportunity to assist the applicant in deciding whether to join the USAR or RA and in selecting an MOS, typically through several meetings. This interaction between applicant and recruiter begins the maturation process of the prospect by aligning what is perceived as life in the Army with actually serving in that Army. The initial focus of Choplin and his colleagues was on the relationship between recruiter and applicant and his/her assimilation into Army life.

The recruiting of non-prior service applicants is handled by the United States Army Recruiting Command (USAREC) as the only command that recruits both USAR and RA Soldiers. Soldiers who have prior-service experience are recruited by USAREC Human Resources Command (HRC), which focuses on those Soldiers leaving active duty and United States Army Reserve Command (USARC), which utilizes the Individual Ready Reserve (IRR) database. Once the Soldier joins the Reserves, the recruiter's job is complete and the new Soldier receives a sponsor from the unit as part of the Command Sponsorship Program. The sponsor and the full-time support members of the unit provide the initial unit integration as directed by the commander. The study looked at these interactions, and referenced Dr. Fredric Jablin's four stages of socialization (anticipatory socialization, organizational encounter, metamorphosis, and exit) to show how Soldiers and units meld.¹⁰ "The anticipatory socialization stage of the model is categorized by the Reservist receiving information from sources which form the newcomer's first impressions and expectations of the Reserves."¹¹

Using the survey method the authors asked questions related to Soldiers' initial beliefs and concepts about their prospective unit and MOS. The authors learned that the majority of Soldiers gained knowledge about the Army and the TPU from their recruiter. However, nearly 50 percent of the Soldiers who received information from their recruiters said it was less than accurate.¹² This initial miscommunication or misinterpretation provides false and potentially impossible expectations that contribute to dissatisfaction. The requirements for the recruiter to take the applicant to the TPU vary, but during this study the majority of recruiters delivered the Soldier to the unit while simultaneously explaining the mission.¹³ Despite the efforts of recruiters and members of the unit, the Soldiers who have unobtainable expectations or envision lofty goals are inclined to become Unsatisfactory Participants due to disappointment in the unit or personnel.

Expectations are enhanced or diminished by those Soldiers already in the unit. Once the Soldier arrives at the unit, he begins to meet fellow Soldiers, i.e., enters the encounter phase in which expectations are either achieved or discovered to be far-fetched. If the Soldier's encounter is positive he begins the metamorphosis stage, which "marks the newcomer's alignment of expectations to those of the organization, otherwise dissatisfaction may lead to missed Battle Assemblies."¹⁴ The questions asked by the researchers centered on the initial reception by the unit, commanders brief and sponsorship programs. Over 70 percent of the new Soldiers completed in processing within the first two drill weekends.¹⁵ The authors found that 11 of the surveyed Soldiers left during the encounter phase; with all but two of the departures blamed on the unit (two did not have adequate transportation).¹⁶ This exodus so early in a military career could

indicate a lack of dedication and commitment and very little knowledge of military operations.

Although Jablin does not tie a quantifiable time to each of his phases, it appears that the Soldiers in the anticipatory socialization, encounter, and metamorphosis stages do not have enough time in the unit to make educated decisions. The metamorphosis stage should be a time when the Soldier becomes more committed to the unit and vice versa, but these newly minted Soldiers found training, administrative functions and leadership worse than expected.¹⁷ The final stage of the indoctrination and unit alignment is exit, which is the ceasing of fulfilling his/her contract requirements. The main fact from the exit section is that only 41 percent of the Unsatisfactory Participants received contact from anyone from the unit; this suggested that they had not become contributors to the unit and there were failures in the sponsorship program. The study suggested that 70 percent of the Soldiers surveyed would rejoin the unit if issues were resolved. However, the perception associated with this recommendation is that if Soldiers stop making formations, then units will alter the unit's tactics, techniques and practices; thus the delinquent Soldier is rewarded for his actions.

Regression

Shelley Perry, James Griffith and Terry White demonstrate how previous research had been contradictory and had failed to provide a clear picture of identifiers for Unsatisfactory Participants. In the research article entitled "Retention of Junior Enlisted Soldiers in the All-Volunteer Army Reserve," Perry et al. discovered a high correlation between prior-service Soldiers with low educational and low aptitude levels and high rate of separation, while other studies divulged the fact that "personal characteristics" have

very low explanatory power.”¹⁸ Job satisfaction for reservists is a driving factor in staying in a unit regardless of incentives, while significant changes in lifestyle greatly impacted the likelihood of attriting from the reserves. The difficulty with identifying characteristics that may lead a commander to better predict who will become an Unsatisfactory Participant is still as much of a problem in 2011 as it was 10 years ago.

Perry, Griffith, and White in 1991 conducted a quantitative analysis to try to determine likely predictors of Unsatisfactory Participants by using multi-year samples from over 3,500 TPUs.¹⁹ The study focused on rank, age, marital status, ethnicity and gender - weighted to gain proportionality among the sample. The researchers developed survey questionnaires to answer a variety of questions ranging from reasons for joining the reserves to reasons why Soldiers stop coming to drills. The responses were graded from most likely to not likely, and given a numerical value to lay the qualitative analysis foundation. The study used correlation analysis, which showed that the following variables were not significant predictors of Unsatisfactory Participants: “gender, marital status, prior active-duty experience, unemployed status, full- or part-time employment in a civilian job, annual income, and ‘MOS.’”²⁰ The fact that the above factors had limited strength in identifying Unsatisfactory Participants led the researchers to begin conducting analysis using three regression models, which consisted of varying the model variables from solely career intent (Soldier centered) to the impact on career intent when taking family into account. These variables were created as a result of Soldiers’ answers to a questionnaire.

Regression modeling involves weighing the correlation between factors to determine their ability to serve as predictors. Through modeling the researchers found the

strongest predictors of a Soldier leaving the service were a lack of “skill development, lack of belonging to and personal meaning in the Army Reserve, and pay problems.”²¹ The correlation between civilian and military life was found to be tied to spousal approval and the degree to which the drill weekends disrupted the home.²² The authors combined all the factors and looked at the linkages between not only age, ethnicity, and education, but also less tangible factors from impressions of the unit to family perceptions. These combined factors indicated attrition to be centered “on perceptions of Soldiers that they are not important contributors to the unit, that they are not worthy of job- and military-skill development and utilization, and that leaders do not recognize their importance.”²³

The study suggested that junior enlisted, high school educated, white males had the highest likelihood of attriting, but this also represents the largest demographic in both Reserves and Regular Army. Once these commonalities are accounted for, the study tends to demonstrate that the perceptions of the unit by the family and the feelings of self-worth and potential for advancement are additional intangible factors. If it were not for these intangible factors, then the commanders could concentrate more easily on those Soldiers with similar visible characteristics of Unsatisfactory Participants. Identifying the common factors of the Unsatisfactory Participants was the main goal of this study and the authors provided relevant data-centric analysis for commanders.

The three studies reviewed in this chapter have a wide range of research methodology for conducting analysis, but all have a common underlying goal of identifying the characteristics of an Unsatisfactory Participant. However, all three of the studies demonstrate that creating a general description of an Unsatisfactory Participant is

a difficult task because of intricacies of determining demographic and social interactions. When conducting analysis the researchers are normally at the mercy of the data and sources, which implies the possibility of different outcomes depending on the available data. Chapter 3 will consider the use of various descriptive data to determine which factors, if any, have any significance in predicting attrition due to Soldiers ending their service prematurely.

¹Kathryn M. Kocher and George W. Thomas, “Profile of Unsatisfactory Participant Losses from the USAR” (Master’s Thesis, Naval Postgraduate School, Monterey, CA, 1999), 1.

²Ibid.

³Ibid., 9.

⁴Ibid..

⁵Ibid..

⁶Ibid., 59.

⁷Ibid.

⁸Ibid., 60.

⁹Bob Barrios-Choplin, Aimee Kominiak, and George W. Thomas, “Reasons for Unsatisfactory Participation in the Army Reserve” (Master’s Thesis, Naval Postgraduate School, Monterey, CA, 1999).

¹⁰Ibid., 16.

¹¹Ibid., 25.

¹²Ibid.

¹³Ibid., 30.

¹⁴Ibid., 16.

¹⁵Ibid., 31.

¹⁶Ibid.

¹⁷Ibid., 40.

¹⁸James Griffith, Shelley Perry, and Terry White, “Retention of Junior Enlisted Soldiers in the All-Volunteer Army Reserve,” *Armed Forces and Society* (1991): 113.

¹⁹Ibid., 116.

²⁰Ibid., 120.

²¹Ibid., 121.

²²Ibid.

²³Ibid., 130.

CHAPTER 3

RESEARCH METHODOLOGY

The objective of this thesis is to develop a model that assists commanders in identifying characteristics that explain why Soldiers become Unsatisfactory Participants. The present chapter begins with a discussion of data selection and software to be used for calculations. The subsequent section discusses model selection criteria followed by the model output and the procedure for converting input variables into a useful format. The final portion of this chapter discusses expected outcomes and hypothesis testing.

Data Inputs and Software

When a commander looks around the formation, each Soldier can be identified readily by various visible traits such as gender and race, while other characteristics may not be visible, i.e., marital status. However, the combination of these characteristics helps to create a better picture of the Soldier. This grouping of characteristics leads to the quest to find a combination that helps to identify commonalities in those Unsatisfactory Participants versus those attending regularly. Given previous research, the data used in this study include ten separate characteristics for each Soldier chosen based upon historical data, descriptive value, and availability. The individual innate characteristics are gender and ethnicity while data points that are subject to change are age, rank, MOS, location (UIC), Regional Support Command (RSC)/Major Support Command (MSC) (which is a grouping of UICs by state as seen in figure 2) and marital status. The only characteristic not innate or quickly subject to change is whether or not the Soldier has

prior service experience. These characteristics, coupled with the Soldier's performance status, provide the variables used in the development of a model.

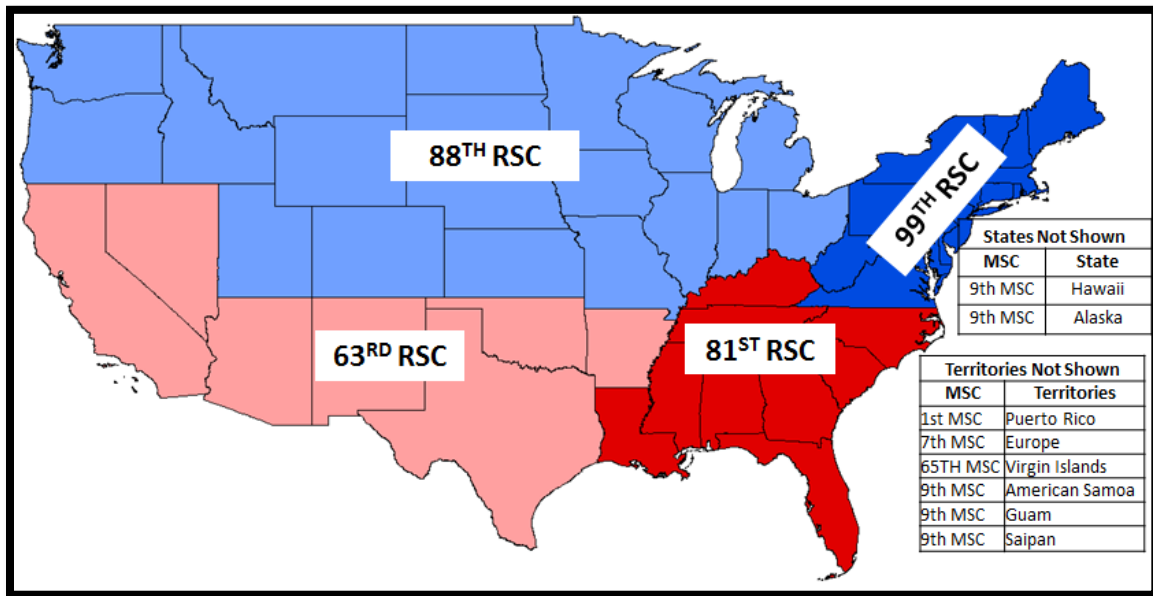


Figure 2. RSCs/MSCs

Source: Created by author with data from Army Reserve, G-1, Manning Division. The RSCs are those CONUS (Continental United States) units while the MSCs are OCONUS (Outside of the Continental United States).

Three sequential steps were necessary to produce an acceptable explanatory model: data preparation, model determination, and error checking. First, in December 2011 Army Reserve, G-1, Manning Division provided data for each individual TPU Soldier in Microsoft Excel. These were prepared for model use by converting categorical data into numerical values followed by pairing with participation status (Satisfactory or Unsatisfactory). Once the data were properly coded, the various data points were reviewed for accuracy and missing values. The next step was to determine the form of regression that produced the optimal model given that the dependent variable can only

assume two values and that there are multiple independent variables. Once the model type was determined and run, the final step was error checking coupled with reviewing measures of performance to determine the explanatory power of the model. Thus, the goal of this chapter is to determine if there are variables that can be modeled to assist commanders in identifying characteristics of incoming Soldiers that may lead to an increased chance that they become Unsatisfactory Participants.

The primary software used to prepare the data for conducting regression analysis was Microsoft Excel. However, due to concerns about regression output using Excel, the open source Software, *R* (www.r-project.org), was utilized to conduct regression analysis with Analysis 6 (Analysis Studio) for verification. The demographic data used in this thesis had an “as of” date of September 2011. Due to data utilization coming from a time slice, slight changes in reported and actual data were possible - for example, a Soldier may have divorced but may not have updated personnel data, thus slightly skewing the personal information. With the completion of data identification for each chosen TPU Soldier, the focus shifts to regression analysis.

Regression Analysis

Regression analysis is defined as “the part of statistics that deals with the investigation of the relationship between two or more variables related in a nondeterministic fashion.”¹ Regression models look to mathematically explain the relationships between independent or explanatory variables, such as age and rank, and a dependent variable—Unsatisfactory Participant, for example.² The difficulty with the topic of unsatisfactory participation is determining which type of model to utilize for the best explanatory analysis. The basic regression model, referred to as a simple linear regression

model, typically entails an interval-scale dependent variable. However, in this study the dependent variable is dichotomous (two possible outcomes)—Unsatisfactory Participant or not. Thus, linear regression is not the best in this instance and another method allowing for multiple variables constrained by the dependent variable data type must be used.

The goal of this thesis is to identify factors that suggest whether a Soldier becomes an Unsatisfactory Participant (the dependent variable), or not. Because of the nature of the dependent variable, the use of logistic regression appears appropriate since it is “well suited for describing and testing hypotheses about relationships between a categorical outcome variable and one or more categorical or continuous predictor variables.”³ The method of logistic regression used for this thesis is stepwise, which “is designed to find the most parsimonious (stingy or restrictive) set of predictors that are effective in predicting the dependent variable. Variables are added or removed from the logistic regression equation one at a time. After each variable is entered, each of the previously included variables is tested to see if the model would be better with the latter variable excluded.”⁴ Factors excluded by the process are assumed in this thesis to be unrelated to the dependent variable. In some studies stepwise regression is frowned upon because the software makes the decision for inclusion/exclusion; however, in predictive and exploratory research stepwise regression is commonly used.⁵ This research attempts to determine a predictive model and thus stepwise logistic is chosen with the selection of each variable reviewed in each step.

Using logistic regression, the probability that an event will occur based upon provided explanatory variables will be denoted by Y , while each explanatory variable will be represented by an X with a numerical subscript to show each is a unique variable. The

final component of the logistic regression model, which is part of the output, is the regression coefficients (or multipliers) for each of the X terms, denoted by β . The α (the intercept term) and the β terms are estimated by applying the method of least squares regression to the logarithmically transformed odds ratio to “maximize the likelihood of reproducing the data given the parameter estimates.”⁶ Typically in linear regression, the α and β terms are estimated using the least squares method, but because the dependent variable is dichotomous this is not the best estimation method for logistic regression.

There are two interpretations of the outcome from logistic regression depending on the desired output: (1) the outcome is a representation of odds using the logit or natural log of the odds ratio as seen in figure 3, with π representing the probability of Y occurring or (2) the outcome is a probability estimate as in figure 4⁷ and is derived from figure 3 by solving for π . For this thesis figure 4 will be the method used to display and discuss the outcomes from modeling. However, either outcome method requires the transformation from demographic data to quantitative data among TPU Soldiers. The model potentially will include interactions of the variables to see if a combination is more telling than just using the using individual variables alone. For example, grade and age provide explanatory power but inclusion of the combination (grade*age) may demonstrate greater explanatory power.

$$\text{odds} = \text{logit}(\pi) = \ln\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta_1 X_1 + \dots + \beta_k X_k$$

Figure 3. Logistic Regression Model–(Natural Log of Odds Ratio)
Source: (Formula constructed data provided from www.luna.cas.usf.edu). The subscripts are used to represent the different factors and the related coefficients regression. The symbol α signifies the intercept while $\beta_1 X_1$ is the combination of the coefficient (β) and the variable (X).

$$P(\text{Unsatisfactory Participant}) = \pi = \frac{e^{\beta_0 + \beta_k X_k}}{1 + e^{\beta_0 + \beta_k X_k}}$$

Figure 4. Logistic Regression Model–Probability (antilog of odds ratio)
Source: Created by author using constructed data from Michael Brannic and the University of Southern Florida Website, “Logistic Regression.” The subscripts are used to represent the different factors and the related regression coefficients. β_0 represents the constant for example while $\beta_k X_k$ is the last factor and its corresponding coefficient.

Taking the dependent variable (π), the probability that the Soldier is an Unsatisfactory Participant, and dividing by the probability that the Soldier is a Satisfactory Participant creates the odds calculation $\left(\frac{\pi}{1-\pi}\right)$. The logit (the natural log of odds) is used as an intermediate step to compute the odds of being an Unsatisfactory Participant.⁸ The β terms relate to the effects the associated variables have on the logit, with large positive terms having a greater positive effect and conversely when negative. If the goal is a probability instead of the logit, this is derived by exponentiation and then by solving for π . For further discussion of natural log and exponentiation, see chapter 13 of *Probability and Statistics for Engineering and the Sciences* (2008) by Jay Devore.

Data Transformation/Selection

The first step taken to prepare the selected data for input is to verify their quality to ensure there are no gaps or missing information. Missing information such as PMOS, age, and race, required 1,478 data points to be removed from the study. Of these, 17 were Unsatisfactory Participants. To create a dichotomous model, the number of missed drills is transformed into either Unsatisfactory Participant (missed drills at least nine times) or not, represented as a 1 or 0 with 1=Unsatisfactory Participant and 0=Satisfactory Participant for all 184,517 TPU Soldiers. This resulted in 11,775 Soldiers coded as a 1, or

as an Unsatisfactory Participant. So, the percent of Unsatisfactory Participants is $\pi =$

$\frac{11,775}{184,517} = 0.064$, and furthermore the odds of being an Unsatisfactory Participant is

$$\left(\frac{\pi}{1-\pi} \right) = \frac{.064}{1-.064} = .068.$$

Next, all verbal descriptors must be coded in order to be modeled. An example of this kind of coding is taking gender terms of female and male and replacing them with a 1=female and 2=male. Once all the data are converted to numerical representations, they can be inserted into the model. The outcome is merely a process executed by the computer software, but the results must be reviewed to determine efficacy and resulting errors.

The final step before implementation is to select a group, or sample, from the entire number of TPU Soldiers, or population, to be modeled. This step is necessary due to software limitations available for this thesis—a maximum of 100,000 possible rows could be computed using the purchased version of Analysis Studio software used to verify the output from *R*. The results of this step provide the model for the sample, which is annotated by *n*. If the model had included all variables then *N* would have been used to represent the population. The sample size should be at a minimum 10:1, but at least 50 to provide the opportunity to select a reasonable representation of the population.⁹ The sample selected for this thesis is a stratified sample, which “entails separating the population in non-overlapping groups and taking a sample from each one.”¹⁰ The groups for sampling are the RSCs/MSCs with 25 percent, or 46,131 Soldiers, taken from each and chosen by assigning a random number to each Soldier and then ranking from highest to lowest. The stratified sample provides a more confined sample ensuring that all

RSCs/MSCs are included while the use of a random number generator ensures no bias in data selection. This method of data selection yielded 2,991 Unsatisfactory Participants or 6.48 percent with the remaining 43,140 as satisfactory performers for the purpose of modeling.

Model and Variable Inclusion/Exclusion

The determination of whether or not a variable is included in the model will be based on the p-value, which is defined as the “smallest level at which the data is significant.”¹¹ The p-value is computed from a formula or obtained from tabled values; if the computed p-value is smaller than .05 the corresponding variable is assessed as significant (with a maximum 5 percent chance of error) and should be included in the model. The computations for the p-value is outside the scope of this thesis, but can be reviewed on page 15 of *Probability and Statistics for Engineering and the Sciences* (2008) by Jay Devore.

Purpose/Output

The output from the logistic regression program includes the model equation itself and a variety of statistical summaries. This output from the program helps in determining the value added by the inclusion of the variables as well as the selection of the model. The model will be evaluated using hypothesis testing to see if it provides a better fit for the data than under the null hypothesis (H_0) that no variables help explain Unsatisfactory Participants. The definition of hypothesis testing is:

The null hypothesis underlying the overall model states that all β s (coefficients) equal zero. A rejection of this null hypothesis implies that at least one β does not equal zero in the population, which means that the logistic regression equation

predicts the probability of the outcome better than the mean of the dependent variable Y.¹²

The null hypothesis implies that the coefficients associated with all the variables are equal to zero, i.e. that there are no significant explanatory variables for Unsatisfactory Participants.

The test of significance based on the p-value is further refined by determining the explanatory power of each variable, assessing the adequacy of the model fit to the output, and finally reviewing the predictions of the model. Part of the evaluation of the models is to look at the goodness of fit measurement (Akaike Information Criteria (AIC)) for each model, with the lowest being deemed the best fitting model, to see if the modeled data are more predictive than not using a model. AIC is determined by multiplying 2 by the number of parameters and subtracting 2 times the natural log of the likelihood (ratio), which produces a value to be compared against other models; see figure 5. “The likelihood ratio approach can be used to provide a test of significance of regression in logistic regression.”¹³ The AIC approach to comparing models does not validate the accuracy or worth of the models, it is only used as a comparative tool.

In itself, the value of the AIC for a given data set has no meaning. It becomes interesting when it is compared to the AIC of a series of models specified a priori, the model with the lowest AIC being the “best” model among all models specified for the data at hand. If only poor models are considered, the AIC will select the best of the poor models.¹⁴

$$AIC = 2k - 2 (\ln (L))$$

Where: k = number of parameters

Ln = Natural Log

L = Likelihood or odds ratio

Figure 5. Akaike Information Criteria (AIC)

Source: Created by author using constructed data from Michael Brannic and the University of Southern Florida Website, “Logistic Regression.” The AIC allows the reader to determine which model is best among those selected.

Further Review

Due to the possibility that the results of logistic regression may produce unremarkable findings, this study also includes a review of the empirical data for the TPU Soldiers. Each variable used during the regression analysis will be handled independently to see if there are any clear signs that it can assist the commander in determining Soldiers at risk for becoming Unsatisfactory Participants—e.g., whether the percentage of non-prior service Soldiers failing to make drill requirements is substantially higher than prior-service counterparts. Once the “obvious” nuggets of information are collected a Chi-Square Test will be utilized to finalize the testing done as part of this paper. Not all outcomes will be available using the Chi-Square Tests, for technical reasons.

The Chi-Square Test (χ^2) “is used to determine whether there are significant differences between the observed and expected frequencies.”¹⁵ The result is determined by summing the squared differences between observed and expected values divided by the expected value, as seen in figure 6. This comparison between observed and expected values may be computed for any of the variables. The χ^2 statistic is routinely compared against tabled data of critical values based upon degrees of freedom (number of

parameters–1) along with the p-value. This critical value, for example, for 4 degrees of freedom (5-1=4) and a significance level of .05 using a χ^2 table is 9.488 (as visible in Appendix A.7 of *Probability and Statistics for Engineering and the Sciences* (2008) by Jay Devore). If the χ^2 statistic is less than the critical value, then there is insufficient evidence to reject the null hypothesis that any differences between the observed and expected values could be due to chance and not a “systematic error.”¹⁶ The calculation of the critical value is outside the scope of this thesis.

$$\chi^2 = \sum \frac{(n_k - p_k)^2}{p_k}$$

Where: χ^2 = Chi-Square Statistic
 n_k = the kth observed frequency
 p_k = the kth predicted frequency¹⁷

Figure 6. Chi-Square Statistic Calculations

Source: Created from Thad Mirer, *Economic Statistics and Econometrics*, 344. The χ^2 allows the reader to determine if the differences between observed and predicted values are due to chance or if there is a systematic error.

This chapter provided the guidelines for conducting testing by describing the inputs, or variables, and by determining which of these variables aid in predicting the outcome, or dependent variable. Furthermore, additional testing definitions are contained in this chapter to understand the data review in chapter 4 better. These evaluation results will be discussed further as part of the findings in chapter 4 along with the results of the model selection.

¹Jay L. Devore, *Probability and Statistics for Engineering and the Sciences* (Belmont, CA: Duxbury, 2008), 447.

²Ruth Ravid, *Practical Statistics for Educator* (Lanham, MD: University Press of America, 2005), 111.

³Gary M. Ingersoll, Kuk L. Lee, and Chao-Ying R. Peng, “An Introduction to Logistic Regression Analysis and Reporting,” *The Journal of Educational Research* 96, no. 1 (September/October 2002): 4.

⁴University of Texas, “Solving Problems in SPSS,” http://www.utexas.edu/courses/schwab/sw388r7_spring_2007/SolvingProblemsInSPSS/Solving%20Stepwise%20Logistic%20Regression%20Problems.ppt (accessed February 24, 2012).

⁵Scott Menard, *Applied Logistic Regression Analysis*, 2nd ed. (Thousand Oaks, CA: Sage University, 2002), 63.

⁶Peng, 5.

⁷*Ibid.*

⁸Michael Brannic, “Logistic Regression,” <http://www.luna.cas.usf.edu> (accessed 21 January 2012).

⁹Peng, 10.

¹⁰Devore, 7.

¹¹*Ibid.*, 313.

¹²*Ibid.*, 5.

¹³Douglas Montgomery, Elizabeth Peck, and Geoffrey Vining. *Introduction to Linear Regression Analysis*, 4th ed. (Hoboken, NJ: JohnWiley, 2006), 436.

¹⁴Marc J. Mazerolle, “Making sense out of Akaike’s Information Criterion (AIC),” <http://archimede.bibl.ulaval.ca/archimede/fichiers/21842/apa.html> (accessed April 10, 2012).

¹⁵Ravid, 153.

¹⁶*Ibid.*, 155.

¹⁷Thad Mirer, *Economic Statistics and Econometrics* (New York: Macmillan, 1983), 344.

CHAPTER 4

FINDINGS

The purpose of this thesis is to answer the primary research question: what characteristics, if any, best explain a Reservist's missing scheduled drills and Annual Training? In answering the primary question, this thesis also aims to look at those factors that are significant to improving the identification of future Unsatisfactory Participants. Answers, or lack thereof, to these questions may suggest that commander's discretion needs to be reviewed at a later date. Attacking the problem statistically allows for the evaluation of data to provide commanders a quantitative framework for identifying potential Unsatisfactory Participants.

Once the individual factors are selected, their combination leads to the development of a model for explaining Unsatisfactory Participants. Two basic questions must be answered to assess the validity and usefulness of the model selected for its explanatory strength.

1. How well does the overall model work?
2. If the overall model works well, how important is each of the independent variables?¹

This model must have greater explanatory power than just guessing who will become an Unsatisfactory Participant. All variables that are statistically significant warrant inclusion in the recommended model. These factors contribute to the likelihood of becoming an Unsatisfactory Participant, but provide no guarantees. This chapter will review the findings to demonstrate that the included variables and their interactions provide the greatest explanatory power for commanders.

The GLM (Generalized Linear Model) library of functions in the software package R (<http://www.r-project.org/>) performed the statistical tests necessary not only to produce the calculations to select the significant variables, but to determine the model itself. Three of the ten original variables (gender, marital status, and primary MOS) were eliminated immediately because their p-values were greater than .05. These variables are unlikely to contain significant explanatory information. Each time a variable is added or removed a new AIC will be generated. The decision to continue looking at more models is reliant upon each subsequent model having a lower AIC than its predecessor; if not, the process concludes that the best model has been identified. This best regression model, the one with the lowest AIC, includes only variables that are statistically significant.

Model Selection

The left panel of table 3 shows the culmination of the first three steps of stepwise regression (variables being removed at each model iteration not meeting certain criteria). The first three iterations removed gender, marital status, and PMOS from consideration for inclusion in the model. The basis for elimination of these factors from the model (column two) is that the corresponding p-values are greater than .05. The intercept (expected value of the dependent variable), which is the first variable listed in table 3, is a constant term contained in each formula unless equal to zero. The software package R also helps in the analysis by the default symbol of * to right of the p-value with a single (*) representing some usefulness to a maximum of three (***). No asterisk in the third column implies that the corresponding variable provides no contribution to the model. The AIC (relative measure of goodness of fit) of the model with all the variables included and no interactions proves to be the worst (20876). The AIC value is used only to

compare different models. There is minimal improvement to the AIC following the removal of the three non-statistically significant variables (20874). The smaller the p-value is, the greater significance the associated variable has in the model. The right panel of table three shows the fourth iteration of model selection with only race and state not having the maximum level of significance.

Table 3. Output of Logistic Regression without Interaction					
Variable	P-value (to 5 places)		Variable	P-value (to 5 places)	
Intercept	0.00921	**	Intercept	0.00007	***
Grade	0	***	Grade	0	***
PS (No)	0	***	PS (No)	0	***
Age	0	***	Age	0	***
Marital	0.14638		Race	0.00169	**
Gender	0.19683		UIC4	0.00011	***
PMOS	0.31275		State	0.04042	*
Race	0.00263	**	RSC	0.00004	***
UIC4	0.00008	***			
State	0.04445	*	AIC	20874	
RSC	0.00004	***			
AIC	20876				

Source: Created by author. Table data from the output from summary function of GLM library in *R*. This depicts how the model is improved by removing gender, marital status, and PMOS as variables.

After 13 iterations the final model was identified (figure 7). Upon including two-way interactions (e.g., age and prior service status) the p-value becomes unreliable as a metric for assessing goodness of fit. Once the interaction terms are introduced, the primary selection device is the AIC. The model finally selected has the lowest AIC of all

the competing models, with AIC equal to 20761. The regression coefficient estimates (column two) are used along with the variables to create the model shown in Figure 8. To determine the probability that a Soldier will become an Unsatisfactory Participant, the Soldiers' data values will be multiplied by the corresponding coefficient estimates, with results closer to unity being interpreted as suggesting greater probability of missing drills.

```
Call:
glm(formula = unsat ~ grade + ps + age + race + uic4 + state +
    rsc + ps:age + grade:age + race:rsc + age:uic4 + grade:ps +
    state:rsc + uic4:rsc + ps:uic4 + grade:uic4 + age:rsc + race:uic4 +
    grade:rsc, family = binomial)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-0.9534  -0.4165  -0.3540  -0.2116   4.2645

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -3.454154370  1.010024857  -3.420  0.000627 ***
grade         0.102367058  0.077237432   1.325  0.185053
ps            2.312019976  0.404452730   5.716  0.0000000109 ***
age           0.029438750  0.025474680   1.156  0.247841
race          -0.154925252  0.060726798  -2.551  0.010736 *
uic4          -0.000262462  0.000345220  -0.760  0.447091
state         0.006952393  0.004011642   1.733  0.083086 .
rsc           -0.023651570  0.106254285  -0.223  0.823851
ps:age        -0.024737391  0.006230985  -3.970  0.0000718541 ***
grade:age     -0.003545616  0.001399335  -2.534  0.011284 *
race:rsc      0.026772988  0.008335111   3.212  0.001318 **
age:uic4      0.000018121  0.000005725   3.165  0.001549 **
grade:ps      -0.080576740  0.028719782  -2.806  0.005022 **
state:rsc     -0.001637808  0.000701459  -2.335  0.019551 *
uic4:rsc      0.000044742  0.000023659   1.891  0.058607 .
ps:uic4       0.000177730  0.000083195   2.136  0.032654 *
grade:uic4    -0.000053112  0.000025228  -2.105  0.035265 *
age:rsc       0.003612557  0.001699853   2.125  0.033569 *
race:uic4     0.000047531  0.000029924   1.588  0.112199
grade:rsc     -0.011518097  0.007803522  -1.476  0.139940
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 22150  on 46130  degrees of freedom
Residual deviance: 20721  on 46111  degrees of freedom
AIC: 20761
```

Figure 7. Model Comparisons with Interaction

Source: Created from summary function of GLM library in R. This figure depicts how the best model is achieved through the introduction of interaction terms.

For example, consider a model using only the rank of Specialist (E4). The corresponding numeric value of an E4, 14 from Appendix C, is multiplied by the

regression coefficient for rank; all other variables are set equal to zero, yielding a formula reflecting rank and the constant (intercept) term: $\left(\frac{1}{1+e^{(-(-3.45+14*.1))}}\right)=.114$. In other words, given 100 E4s, about 11 are expected to become Unsatisfactory Participants when no other factors are considered. Typically, however, more information will be available, since if only rank is known then using the model results in a Major (O4) having a 26 percent chance of becoming an Unsatisfactory Participant. Using age and rank and their interaction demonstrates that a 21-year-old E4 (.069) has a higher chance of becoming an Unsatisfactory Participant than a 38-year-old O4 (.027).

$$1/(1+\exp(-(-3.45 + 0.10\text{grade} + 2.31\text{ps} + 0.03\text{age} - 0.15\text{race} - 0.0003\text{uic4} + 0.007\text{state} - .02\text{rsc} - 0.02\text{ps:age} - 0.004\text{grade:age} + 0.03\text{race:rsc} + 0.00002\text{age:uic4} - 0.08\text{grade:ps} - 0.002\text{state:rsc} + 0.00004\text{uic4:rsc} + 0.0002\text{ps:uic4} - 0.00005\text{grade:uic4} + 0.004\text{age:rsc} + 0.00005\text{race:uic4} - 0.01\text{grade:rsc})))$$

Figure 8. Best Model in Coefficient Format

Source: Created from summary function of GLM library in R. By using this model format a commander can input the individual factors and obtain a probability of becoming an Unsatisfactory Participant. The symbol (:) represents the interaction between two terms.

Understanding Coefficients

To better understand the contribution of the coefficients it is useful to place them on the same scale to compare their relative magnitudes and importance to the model.

Standardized coefficients are coefficients adjusted so that they may be interpreted as having the same, standardized scale and the magnitude of the coefficients can be directly compared (ranked). The greater the absolute value of the standardized coefficient, the greater the predicted change in the probability of the outcome given a 1-standard deviation change in the corresponding predictor variable, holding constant the other predictors in the model.²

As seen in figure 8, the coefficients are small with the exception of prior service status and the intercept, which serves as a measure of the unconditional probability of being an Unsatisfactory Participant. The variables, however, have varied types of scales: prior service status can only be “yes” or “no” while battalion level Unit Identification Code (UIC4) has over 2000 possible values. The use of standardized coefficients provides clear evidence of the strength of each variable (figure 9). The larger the magnitude of each variable’s bar is in figure 9, the greater its statistical importance is to the model. For example, lack of prior service experience has a substantial impact on increasing the likelihood of missing BAs while the interaction term between an increase in grade and prior service experience (grade*ps) relates to an increased likelihood that a Soldier regularly makes all drill requirements.

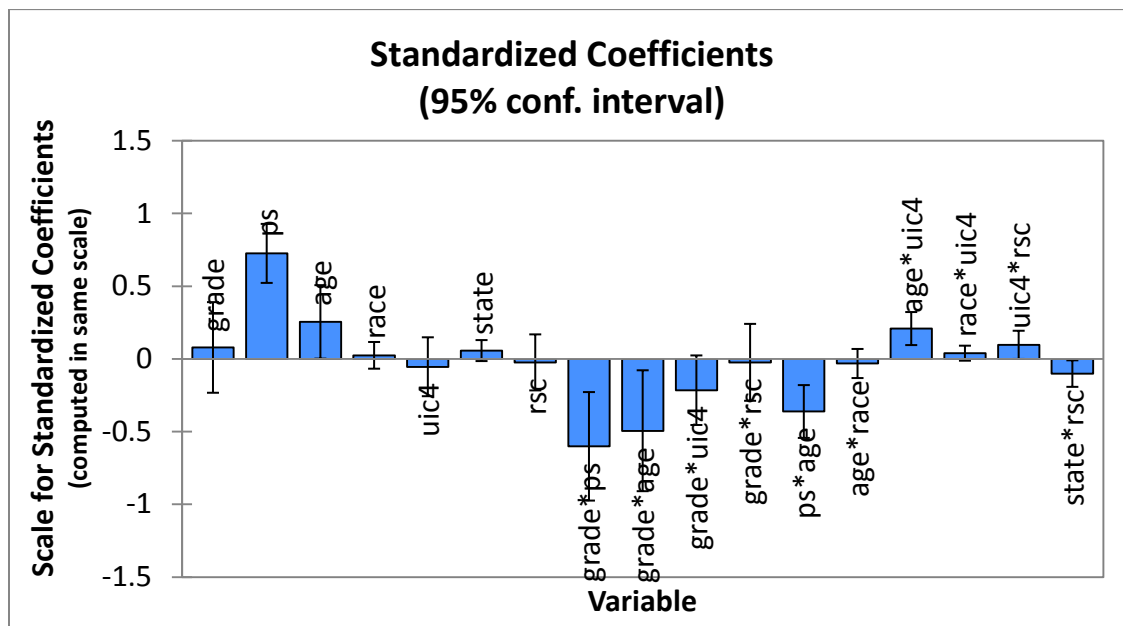


Figure 9. Standardized Coefficients

Source: Created from output from XLstat add-in for Microsoft Excel. By normalizing the coefficients the reader can see how the change in one variable directly effects the other variables.

Model Power

The goal of regression analysis is to identify variables that aid in explaining the variation in the values of a dependent variable beyond pure chance. The best model, as identified by the procedures described above, does have some explanatory power.

However, it does not explain as much of the variation in the dependent variables as might be desired; model accuracy is 62.5 percent correct (table 4) calculated using Analysis Studio 6. To better understand this, there is a need to look at where errors in predicting the likelihood of becoming an Unsatisfactory Participant occur. Two types of errors result from inaccurate labeling of Soldiers: Unsatisfactory Participant labeled as Satisfactory and Satisfactory Participants as Unsatisfactory.

The greatest amount of error occurs when predicting Unsatisfactory Participants. The model incorrectly identified 16,280 Satisfactory Participants as Unsatisfactory while only correctly labeling 1,970 Unsatisfactory Participants for an accuracy rate of 10.8 percent. False positives, mislabeling Satisfactory Participants as Unsatisfactory, can be slightly improved by changing the coding methodology. Recoding all Soldiers missing at least one event increases Unsatisfactory Participants by 1,740 and improves accuracy (10.8 percent to 16.2 percent). On the other hand, the model correctly identifies Satisfactory Participants at a rate of 96.3 percent. The false negatives, misidentifying Unsatisfactory Participants as Satisfactory, happened only 1,021 times (3.7 percent). This much higher accuracy rates for Satisfactory Participants is aided by the much larger population of those who routinely attend training. Table 4 reflects the accuracy for each category.

Table 4. Model Accuracy			
Category	Predicted Satisfactory Participant	Predicted Unsatisfactory Participant	Total Row percent Correct
Satisfactory Participant %	26,860 62.3%	16,280 37.7%	62.3%
Unsatisfactory Participant %	1,021 34.1%	1,970 65.9%	65.9%
Total % Correct	96.3%	10.8%	62.5%

Source: Created by author with data from regression output. The model predicts a Satisfactory Participant at a rate of 96.3 percent of the time, but correctly identifies an Unsatisfactory Participant only 10.8 percent.

Empirical Data Review

Based upon the relatively poor predictive power of the selected model, there is usefulness in reviewing the variables independently to see if there are any that viewed alone provide insight into Unsatisfactory Participants. All 184,517 data points were evaluated during the review of the TPU data and not just the sample used in model selection. First, looking at two dichotomous categories of gender and prior-service status (yes/no) yielded unremarkable results as males and females were about equally likely to become Unsatisfactory Participants (6.3 percent and 6.5 percent, respectively) as were results of prior service status (6.6 percent and 6.9 percent). The second group of variables reviewed was grade and age because of the correlation between the two—the expectation that a junior enlisted Soldier is younger than a Sergeant First Class, for instance.

As seen in Figure 10, over 12 percent of the E2 and E3s routinely fail to attend drill. Also visible in the grades category is the higher rate of Unsatisfactory Participants

in the junior officer ranks (O1-O3). But, what was not expected was warrant officers at the grade of Chief Warrant Officer Three (CW3) have a greater percentage of Unsatisfactory Participants than Warrant Officer (WO1). However, with graphs and percentages, sometimes further review is necessary as there were only 2,366 warrant Officers and 13 Unsatisfactory Participants. The anomalies of CW3s having a spike in the chart stems from a small population; W3s number 358 Soldiers and five Unsatisfactory Participants.

Figure 11 demonstrates that of Soldiers aged 19-25, or those typically serving in grades of E1-E4 and O1-O2, over 10 percent were Unsatisfactory Participants. These two categories alone show what most would expect—younger Soldiers need greater supervision than those who are older, or are in more advanced grades.

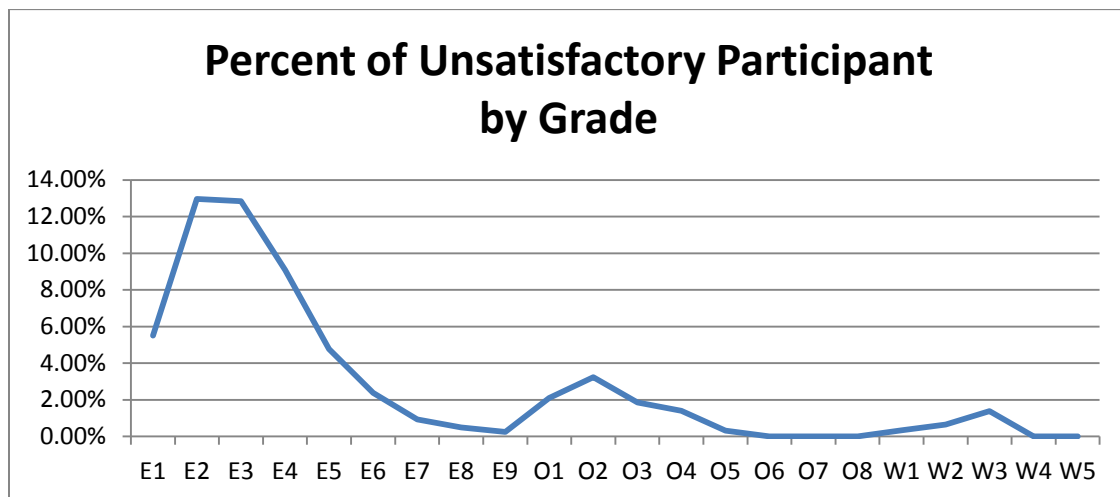


Figure 10. Percent of Unsatisfactory Participants by Grade
Source: Created from output from Microsoft Excel. The graph depicts the percent of Unsatisfactory Participants for each grade. E2-E3 have the highest percent of Unsatisfactory Participants.

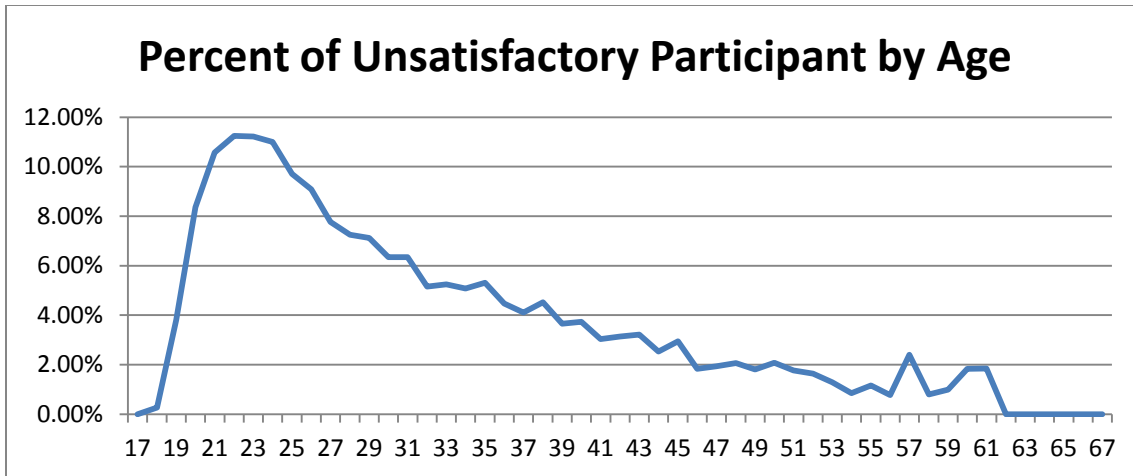


Figure 11. Percent of Unsatisfactory Participants by Age
Source: Created from output from Microsoft Excel. The graph depicts the percent of Unsatisfactory Participants for each age. Younger Soldiers typically have the highest percent of Unsatisfactory Participants.

The next factor is the marital status of the Soldier. Of the eight categories, single and married are the predominant categories. There are over 90,000 single and nearly 79,000 married Soldiers. The other six categories account for just over 15,000, with 14,316 of those being divorced. Of those who are single, eight percent are Unsatisfactory Participants while of those who are married the figure is 4.6 percent. Single Soldiers, those who have never been married, seem to have the greatest risk of having activities that conflict with routine attendance. Even divorced Soldiers have a lower percentage of Unsatisfactory Participants (5.4 percent). The married category has the most instability as a Soldier potentially could change his status more than once in a year. Caucasians constitute 68.9 percent of the USAR force and are 65 percent of the Unsatisfactory Participants. Of Caucasians, 6 percent routinely miss drills while the percentage of Blacks who miss drills is over eight percent. However, Blacks have half the number of

Unsatisfactory Participants as Caucasians. American Indian or Alaska Native Soldiers experienced 131 Unsatisfactory Participants or 10 percent.

The next category examined is PMOS. The top 10 PMOS categories by population (42A, 88M, 31B, 91B, 68W, 92A, 92Y, 74D, 12B, and 92F) in TPUs account for 41 percent of the Soldiers; the percent of these being Unsatisfactory Participants is 7.2 percent.

The final categories are location, to include the RSC/MSC as seen in figure 12 and states (figure 13) since they are all linked to UIC. Over 95 percent of TPU Soldiers belong to the 63rd, 81st, 88th and 99th RSCs (figure 2). The other four RSCs/MSCs collectively contain less than 4,400 Soldiers, to include the 65th RSC which has only 12 Soldiers. The 63rd and 81st RSCs make up 46 percent of the TPU strength, but have a 7.6 percent rate of Unsatisfactory Participants. As far as states go, Alaska and New Mexico have the highest percentages of Unsatisfactory Participants, but Texas, which has the largest number of Soldiers, also has 7.8 percent Unsatisfactory Participants. The geography demographic further demonstrates that Unsatisfactory Participants are found throughout the US, regardless of other factors.

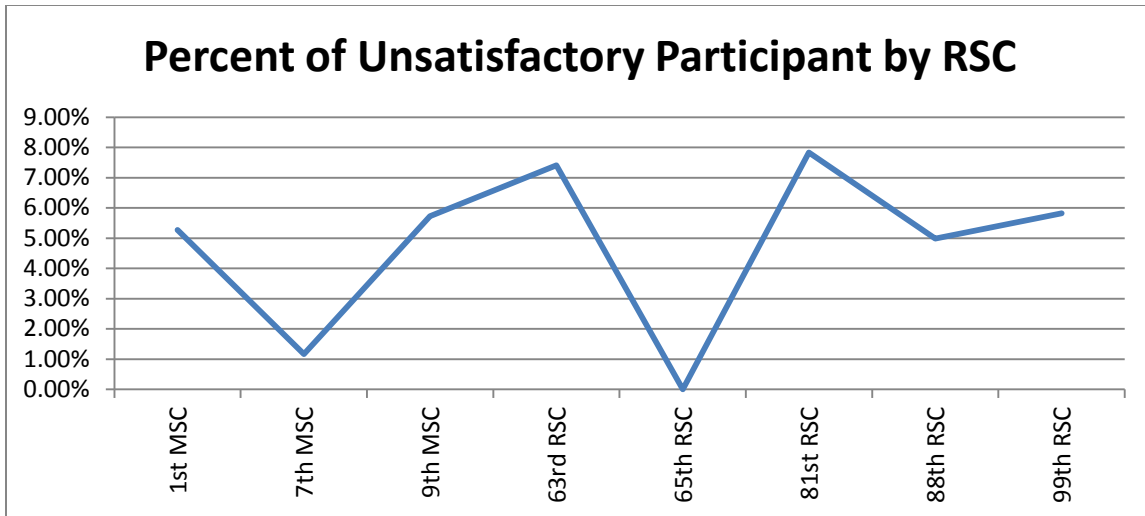


Figure 12. Percent of Unsatisfactory Participants by RSC
Source: Created from output from Microsoft Excel. The graph depicts the percent of Unsatisfactory Participants for each RSC. The 7th MSC and 65th RSC are the two smallest groups.

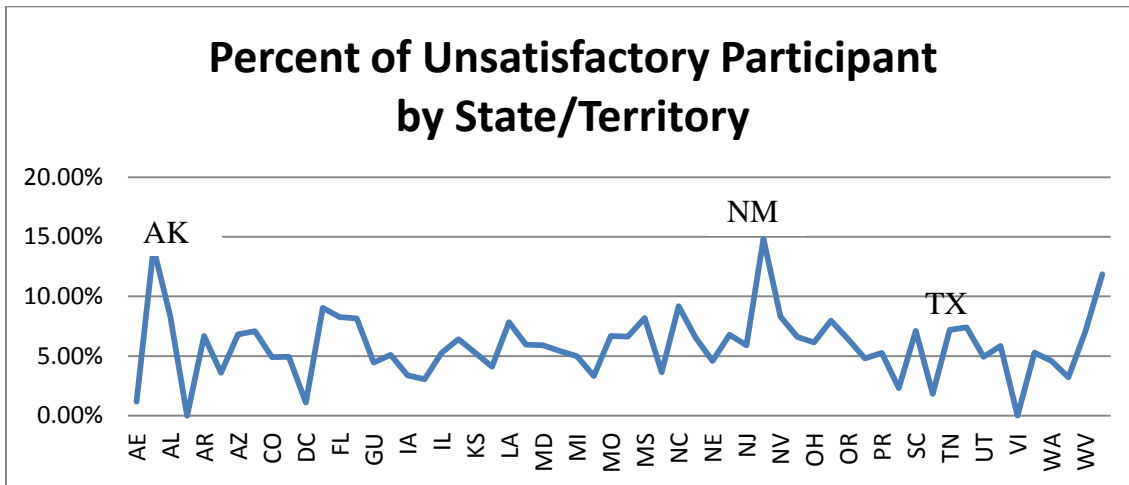


Figure 13. Percent of Unsatisfactory Participants by State/Territory
Source: Created from output from Microsoft Excel. The graph depicts the percent of Unsatisfactory Participants for each State/Territory. New Mexico has the highest percent of Unsatisfactory Participants while Texas has the largest number.

Contingency Tables

The use of contingency tables allows for the comparison between expected and observed values using the Chi-Square Statistic (χ^2) to test for significant differences between the two. The main problem with the use of χ^2 is the errors that might result when expected number of participants in one or more categories is small. This section will review age and grade, and their respective observed and expected Unsatisfactory Participant counts as a way to demonstrate the utility of using χ^2 test. Figures 14 and 15 are created by graphing the results of contingency tables. Figure 14 shows that the observed and expected numbers of Unsatisfactory Participants by grade are nearly identical and offer no insight, except in the case of E3s and E4s. Both of those grades have a higher proportion than expected. When looking at age alone, those Soldiers in the early 20s have a much higher than expected number of Unsatisfactory Participants, and thus indicates a need for greater oversight for Soldiers typically associated with the junior enlisted and officer grades. Figure 15 shows that the greatest differences occur between the ages of 21-26. This is consistent with the contingency table associated with figure 15 showing disposition in E2 and E3.

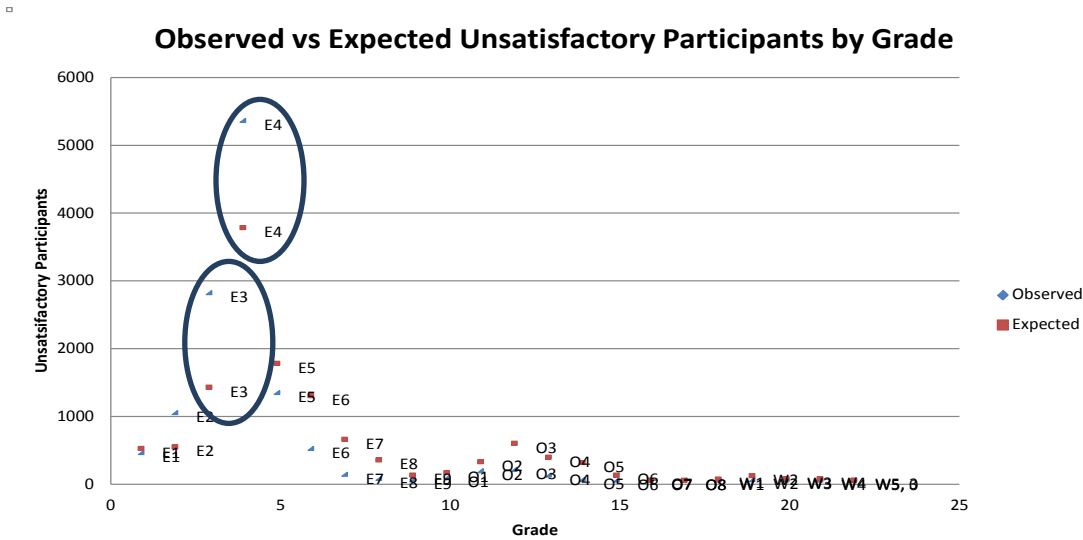


Figure 14. Observed vs. Expected Unsatisfactory Participants by Grade
Source: Created from output from Microsoft Excel. The graph depicts how using Chi-Square Statistic allows for the comparison between what is observed and what is expected. Most grades produce expected results except for E4 and E3.

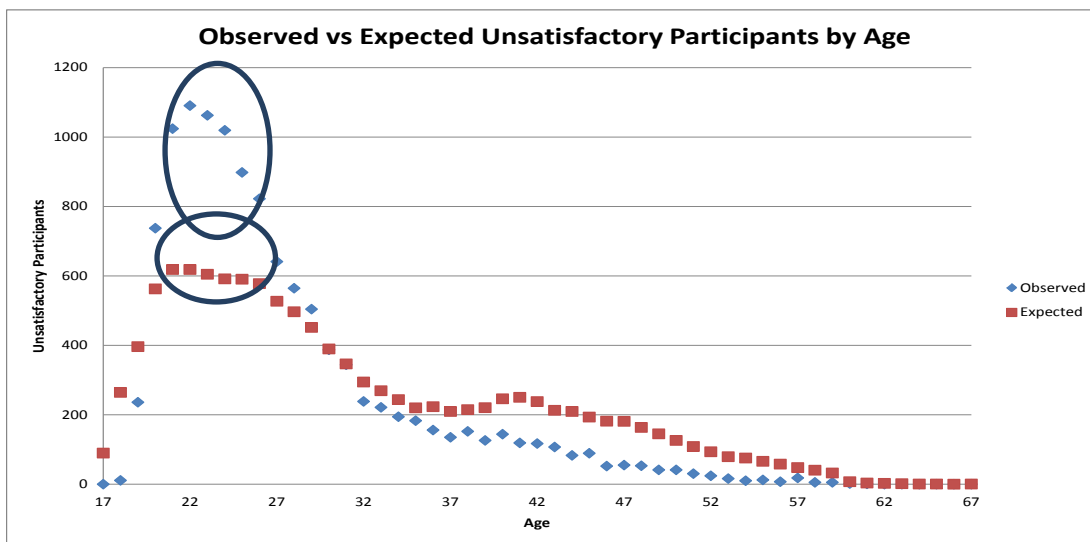


Figure 15. Observed vs. Expected Unsatisfactory Participants by Age
Source: Created from output from Microsoft Excel. The graph depicts how using Chi-Square Statistic allows for the comparison between what is observed and what is expected. Disparities are visible in ages 21-26.

Summary

This chapter described the output of the best logistic regression model for explaining Unsatisfactory Participants and demonstrated how the model was selected from numerous similar candidates. Including interactions between terms produced the most desirable model, while at the same time showing that not all variables have predictive power. The errors associated with the model are magnified by the fact that the data come from a single time slice and cannot account for the increase or decrease in missed BAs. Since the model does not provide a result with strong explanatory power, a review of the data along with the representation of contingency tables through graphs (figures 14 and 15) is completed to allow for interpretation of individual factors. Chapter 5 will provide potential uses of this model, make recommendations on how to improve the accuracy and predictive power of the model, and indicate the potential for further study into the factors that contribute to unsatisfactory participation.

¹Menard, 17-18.

²Doug Thompson, “Ranking Predictors in Logistic Regression” (Paper D10-2009); Assurant Health (Milwaukee, 2009), 2.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This purpose of this paper is to provide a method for commanders to identify those Soldiers likely to become Unsatisfactory Participants to ensure that the Army Reserve can mitigate losses. Logistic regression analysis was used because of the categorical nature of the output data for each TPU Soldier. A model was developed to classify those variables that may help to identify those who fail to attend drill at least nine times in a running calendar year or miss part of Annual Training. The results provided by logistic regression indicated that there are multiple characteristics that help explain Unsatisfactory Participants. These variables appeared to be confirmed by a less complicated empirical review of the data. These findings are consistent with previous studies that affirmed that the most likely Unsatisfactory Participant is a unmarried junior enlisted Soldier aged between 19-25. This reinforced the view that greater supervision and intervention remains necessary for junior Soldiers.

The focus of commanders typically is on the junior enlisted and this need is confirmed by the outcome of this study; the majority of Unsatisfactory Participant Soldiers are junior enlisted. No commissioned grade exceeds 3.3 percent Unsatisfactory Participants with the total number of Officers missing drills at 422 (table 5). The differences between the proportions of Unsatisfactory Participant among enlisted, officers, and warrant officers are discussed as part of recommended future studies in chapter 5.

Table 5. Breakdown of Unsatisfactory Participants			
Source	Soldier Count	Unsat. Part.	% Unsat. Part.
Enlisted	157001	11340	7.2%
Officer	25347	422	1.7%
Warrant Officer	2169	13	0.6%
Total	184517	11775	6.4%

Source: Created by author. Table data from Army Reserve, G1, Manning Division, Ft. Belvoir, Virginia. The counts used in this table are only those with complete information. The total TPU count is 185,995.

Another issue affecting unsatisfactory participation rates is consistency among commanders in coding members as Unsatisfactory Participants. The commander at each unit determines the code assigned to each Soldier missing drill including unsatisfactory participation. The need to get this coding assignment correct and its reasons for doing so are contained on the Army Reserve website:

Commanders must ensure Battle Assembly attendance codes are correctly documented. Service contracts and incentive agreements contain the conditions for termination and recoupment of incentives; however, Soldiers will be counseled immediately on financial and other consequences when they receive their first unexcused absence.¹

To reduce or ultimately remove Unsatisfactory Participants from the ranks of the Army Reserve requires that the commander be able to identify and correct this behavior.

Statistical modeling methods provide a diagnostic management tool for these commanders and staffs to help reduce the count of Unsatisfactory Participants regardless of age, rank, location, etc.

Recommendations

Commanders may utilize the findings from this study to promote awareness for Unsatisfactory Participants as long as they understand that there are limitations to the model. In this thesis ten categorical variables were used for modeling Unsatisfactory Participants. The data collected and used in this thesis consist of a selection from a single month (September 2011) and every data point provides just a one-month snapshot. The model derived from the categorical variables correctly identifies a Soldier as an Unsatisfactory Participant or not 62.5 percent of the time. Thus, there is a need to improve this accuracy. In an attempt to provide commanders with a useful tool for determining the likelihood that a Soldier becomes an Unsatisfactory Participant, there are five recommendations to consider.

The first recommendation is to seek additional demographic variables. Adding other variables might lead to greater explanatory power. These might include such things as socio-economic status and test scores on Army entrance exams. The combination of test scores and PMOS may provide insight into job satisfaction for those Soldiers capable of serving in multiple MOSs. Another category that may have explanatory power is the distance a Soldier must travel for Battle Assemblies. However, in order to use distance as a variable, travel time must also be included in the calculations; fifty miles in a metropolitan area may take longer to travel than in a rural area. By adding more variables a better description of the Soldier can be fostered and a more complete picture possibly could be captured.

The second recommendation for future study, besides adding more categories, would be to look at monthly reports and track by social security number those Soldiers

who become Unsatisfactory Participants and those who were missing drills but begin attending regularly. This would allow for trend analysis for a better understanding of the monthly and yearly fluctuations for individual Soldiers—i.e., it might allow one to address the question of whether the number of missed drills increases during certain months or during Annual Training. Since unsatisfactory participation occurs based on a running yearly count, do Soldiers track when they can miss drills without affecting their status? This could be further examined by tracking data over a longer period than a year.

The third recommendation is to identify all Soldiers who have missed at least one drill event in a yearly running count and track these Soldiers. There currently are nearly 12,000 Unsatisfactory Participants; while over 7,000 more have missed drill at least once. Counting the data in this form would allow for the number of Soldiers watched to be increased by approximately 75 percent. Recoding all Soldiers missing drills, regardless of repetition, illuminates the larger problem of commanders routinely coping with holes in their formations. This could address the current situation where a Soldier can monitor his/her number of missed drills and choose not to attend if they will not become categorized as an Unsatisfactory Participant.

A fourth recommendation would be to code for any missed drill, regardless of reason, to further track by rank those who are absent from formations. This review could help determine if there are a disproportionate number of different reasons accepted by commanders vice unexcused absences for each rank. This coding should be readily available to each commander, at all levels, to help track and manage patterns of attendance at Battle Assemblies.

With the Army likely to become a smaller force, Unsatisfactory Participation should diminish, though it may not disappear altogether. However, before Soldiers are removed from the ranks all efforts to identify potential Unsatisfactory Participants and appropriate intervention should be attempted to retain them and better educate them concerning potential consequences. This thesis did not aim to blindly categorize all Unsatisfactory Participants the same, as there are a multiple reasons why a Soldier fails to attend training. Thus, a final recommendation is for continuing research of all TPU Soldiers to better illuminate difficulties in attending drill, impressions about the unit and satisfaction with service in the US Army Reserves. There must be an understanding of why Soldiers miss drills so that USAR formations remain filled with quality, dedicated and committed Soldiers.

¹United States Army Reserve, “No Excuses! Bonuses at stake for Soldiers with unexcused absences,” <http://www.usar.army.mil/> (accessed October 14, 2011).

APPENDIX A

Excerpt from DA Form 3540

SECTION VI - SATISFACTORY PARTICIPATION

I understand that as a member of the Ready Reserve or Selected Reserve of the U.S. Army Reserve, I must participate satisfactorily during the entire period of my enlistment, reenlistment, immediate reenlistment, transfer, assignment, or reassignment in accordance with the rules and regulations now in effect, or which may hereafter be placed in effect, by the proper authority.

a. **TROOP PROGRAM UNIT.** *If I am assigned as a member of a Selected Reserve troop program unit, my satisfactory participation is determined by the following:*

(1) I will serve as a member of a Selected Reserve troop program unit for the entire period specified in the terms of my service agreement unless otherwise reassigned or separated by proper authority.

(2) I will be required to attend all scheduled unit training assemblies *(at least 48 per year)* unless I am excused by proper authority. I must attend scheduled unit training assemblies in the prescribed uniform, present a neat soldierly appearance, and perform my duties in a satisfactory manner to receive credit for attendance. If I do not receive credit for attendance for any of these reasons, I will be charged with an unexcused absence. *If I accrue nine or more unexcused absences during any continuous 365-day period, I will be declared an unsatisfactory participant.*

(3) I am required to satisfactorily complete a period of annual training of not less than 14 days per year, exclusive of travel time, unless excused by proper authority. *If I fail to attend or complete the entire period of annual training I will be declared an unsatisfactory participant.*

(4) I must keep my commander advised of my current mailing address, where I will receive official correspondence, and I must reply to and comply with all official orders and correspondence that I may receive.

(5) If I have not completed 24 months of active duty/ADT and I am not already reassigned when I change residence to a location too distant to continue participation with my assigned unit, I will be authorized a period of not more than 90 days of leave of absence from training. During this 90-day period I must locate and join another Selected Reserve troop program unit.

APPENDIX B

Termination of Incentive Payments



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY RESERVE COMMAND
4710 KNOX STREET
FORT BRAGG, NC 28310-5000

OCT 31 2011

AFRC-PRM-I

MEMORANDUM FOR

Commanders, USAR Major Subordinate Commands
Commander, 7th Civil Support Command, Unit 29238, APO AE 09102
Commander, 9th Mission Support Command, 1557 Pass Street,
Fort Shafter Flats, Honolulu, HI 96819-2135

SUBJECT: Termination and Recoupment of Incentive Payments for Unsatisfactory Participants

1. References:

a. Memorandum, Deputy Chief of Staff, G-1, DAPE-MPA, 4 Apr 11, subject: Operational Change to AR 601-210 (Active and Reserve Components Enlistment Program) (Change 1) (enclosed).

b. Memorandum, Army Reserve G-1, DAAR-HR, 9 Apr 08, subject: Clarification and Modification of the Selected Reserve (SELRES) Officer and Warrant Officer Affiliation Bonus Agreement Form.

c. Memorandum, Deputy Chief of Staff, G-1, ARRC-PRT-R, 20 Nov 07, subject: Clarification to the Army Reserve Officer/Warrant Officer Accession Bonus.

d. AR 601-210, Active and Reserve Components Enlistment Program, 8 Feb 11.

e. AR 135-91, Service Obligations, Methods of Fulfillment, Participation Requirements, and Enforcement Procedures, 1 Feb 05.

2. Effective 1 Nov 11, Soldiers with an unexcused absence from Battle Assembly (BA) that remains unexcused for more than 90 days will have their Selected Reserve Incentive Program (SRIP) payments terminated. Unsatisfactory participation challenges Army Reserve readiness and fiscal resources. As a result of a US Army Audit Agency Audit (AAA) Report, the Army Reserve continues to focus its efforts in encouraging better methods for attendance management.

3. Operational Change to AR 601-210, dated 4 Apr 11, requires termination and recoupment (any unearned portion) of incentives for Soldiers accruing one or more unexcused absences. AR G-1 identifies Soldiers in RLAS (Regional Level Application Software) who meet the above criteria and initiates termination of their incentives. The effective date of the termination is the date of the first unexcused absence.

AFRC-PRM-I

SUBJECT: Termination and Recoupment of Incentive Payments for Unsatisfactory Participants

4. Although service contracts and incentives agreements contain the conditions for termination and recoupment of incentives, Soldiers need to be counseled immediately on financial and other consequences when they receive their first unexcused absence. It is imperative for Commanders to ensure that excused and unexcused absences are properly documented to alleviate any undue hardship for the Soldier.

5. Units will take the following actions after posting an unexcused absence in RLAS for a Soldier in receipt of incentives:

a. Notify the Soldier of the unexcused absence via the Letter of Instruction – Unexcused Absence (U letter) from RLAS. Additionally, include a letter explaining that AR G1 will initiate termination of his/her incentives and collect any unearned portion if the unexcused absence remains in effect for 90 days. The Soldier must respond to the unit within 15 days of receipt of the U letter to request an excused absence.

b. Update the Soldier's attendance code in RLAS if the Commander authorizes an excused absence. Change the attendance code for the BA from "U" to "A". Failure to make this change within 90 days of the unexcused absence will result in termination of the Soldier's incentives. Attach documents supporting the change to the unexcused absence to the IDT Attendance Roster.

6. Each month, AR G-1 identifies Soldiers in RLAS with one or more unexcused absences that are more than 90 days old and notifies the USAR Pay Center to terminate their incentives. It is critical that Commanders ensure accurate attendance to avoid erroneous termination of Soldiers' incentives.

7. For additional information, contact MAJ Joseph Tsagronis, AR G-1, Manning Division, at 910-570-8744 or MSG Alfred E. Lee, Jr., Manning Division, Deputy Chief of Staff, G-1 at (910) 570-8094 or via email at USARC_Incentives@usar.army.mil.

FOR THE COMMANDER:



B. LYNNE OWENS
Colonel, GS
Deputy Chief of Staff, G-1

APPENDIX C

Demographic Codes

MPC	MPC_code	GRADE	GRADE_ID	MARITAL_STATUS	MARITAL_STATUS_ID
Enlisted	1	E1	11	ANNULLED	1
Officer	2	E2	12	DIVORCED	2
Warrant	3	E3	13	INTERLOCUTORY DECREE	3
		E4	14	LEGALLY SEPARATED	4
PSNPS	PSNPS_ID	E5	15	MARRIED	5
Non	1	E6	16	SINGLE	6
Prior	2	E7	17	WIDOWED	7
		E8	18	UNKNOWN	8
GENDER	GENDER_ID	E9	19		
F	1	O1	21	RSC	RSC_CODE
M	2	O2	22	1st MSC	1
		O3	23	7th MSC	2
		O4	24	9th MSC	3
		O5	25	63rd RSC	4
		O6	26	65th RSC	5
		O7	27	81st RSC	6
		O8	28	88th RSC	7
		W1	31	99th RSC	8
		W2	32		
		W3	33	RACE_POP_GROUP	RACE_POP_GROUP_ID
		W4	34	C	1
		W5	35	M	2
				N	3
				R	4
				S	5
				X	6
				Z	7

Source: Created by author.

Excerpt from Codes					
PMOS	PMOS_ID	UNIT_STATE	State_code	UIC4	UIC4_code
001A	1	AE	1	W0ZZ	1
003A	2	AK	2	W486	2
00A	3	AL	3	W700	3
00B	4	AP	4	W701	4
00D	5	AR	5	W703	5
00E	6	AS	6	W704	6
00G	7	AZ	7	W706	7
00Z	8	CA	8	W707	8
01A	9	CO	9	W708	9
05A	10	CT	10	W709	10
09B	11	DC	11	W70A	11
09C	12	DE	12	W70B	12
09D	13	FL	13	W70C	13
09H	14	GA	14	W70D	14
09J	15	GU	15	W70E	15
09L	16	HI	16	W70F	16
09M	17	IA	17	W70G	17
09N	18	ID	18	W70H	18
09R	19	IL	19	W70L	19
09S	20	IN	20	W70M	20
09W	21	KS	21	W70S	21
11A	22	KY	22	W70U	22
11B	23	LA	23	W70V	23
11C	24	MA	24	W70W	24
11X	25	MD	25	W70X	25
11Z	26	ME	26	W70Y	26

BIBLIOGRAPHY

- Army Reserve. Operational and Functional Commands. <http://www.usar.army.mil/> (accessed October 14, 2011).
- . The Mission of the Army Reserve. <http://www.usar.army.mil/> (accessed October 14, 2011).
- . Training Commands. <http://www.usar.army.mil/> (accessed October 14, 2011).
- . U.S. Army Reserve Command. <http://www.usar.army.mil/> (accessed October 14, 2011).
- Barrios-Choplin, Bob, Aimee Kominiak, and George W Thomas. “Reasons for Unsatisfactory Participation in the Army Reserve: A Socialization Perspective.” Master’s Thesis, Naval Postgraduate School, Monterey, CA, 1999.
- Brannic, Michael. Logistic Regression. <http://luna.cas.usf.edu/~mbrannic/files/regression/Logistic.html> (accessed January 21, 2012).
- Currie, James T, and Richard B Crossland. *Twice the Citizen*. Washington, DC: Government Printing Office, 1995.
- Department of the Army. Army Regulation (AR) 140-145, *Individual Mobilization Augmentee (IMA) Program*. Washington, DC: Government Printing Office, 2007.
- Devore, Jay L. *Probability and Statistics for Engineering and the Sciences*. Belmont, CA: Duxbury, 2008.
- Department of Defense. *DoDI 1215.13, Reserve Component (RC) Member Participation Policy*. Washington, DC: Government Printing Office, 2009.
- Griffith, James, Shelley Perry, and Terry White. “Retention of Junior Enlisted Soldiers in the All-Volunteer Army Reserve.” *Armed Forces and Society* (Fall 1991): 113.
- Janowitz, Morris. *The Citizen Soldier and National Service*. November-December 1979. <http://www.airpower.maxwell.af.mil> (accessed September 9, 2011).
- Kocher, Kathryn M, and George W Thomas. “Profile of Unsatisfactory Participant Losses from the USAR.” Master’s Thesis, Naval Postgraduate School, Monterey, CA, 1999.
- Kominiak, Aimee L. “Determinants of Nonparticipation in the United States Army Reserve.” Master’s Thesis, Naval Postgraduate School, Monterey, CA, 1997.

Menard, Scott. *Applied Logistic Regression Analysis*. 2nd ed. Thousand Oaks, CA: Sage University, 2002.

Mirer, Thad. *Economic Statistics and Econometrics*. New York: Macmillian, 1983.

My Army Reserve. Army Reserve- celebrating 103 Years with Soldiers and Families.
<http://myarmyreserve.dodlive.mil/> (accessed October 14, 2011).

INITIAL DISTRIBUTION LIST

Combined Arms Research Library
US Army Command and General Staff College
250 Gibbon Ave.
Fort Leavenworth, KS 66027-2314

Defense Technical Information Center/OCA
825 John J. Kingman Rd., Suite 944
Fort Belvoir, VA 22060-6218

Dr. Bill McCollum
DCL
USACGSC
100 Stimson Avenue
Fort Leavenworth, KS 66027-2301

Dr. David Bitters
QAO
USACGSC
100 Stimson Avenue
Fort Leavenworth, KS 66027-2301

Mr. William Maxcy
DTAC
USACGSC
100 Stimson Avenue
Fort Leavenworth, KS 66027-2301